



OSTS Winter Training



NAV 101

Plotting Fixes



Agenda



Nav 101

- **Finding lat/long of an object**
- **GPS Fix**
- **Plotting waypoints and a route**
- **Visual Fix**
- **Dead Reckoning**
- **Recording Bearing Log and Navigation Log Entries**
- **Time Distance Calculations**



Exercise: Lat/Long

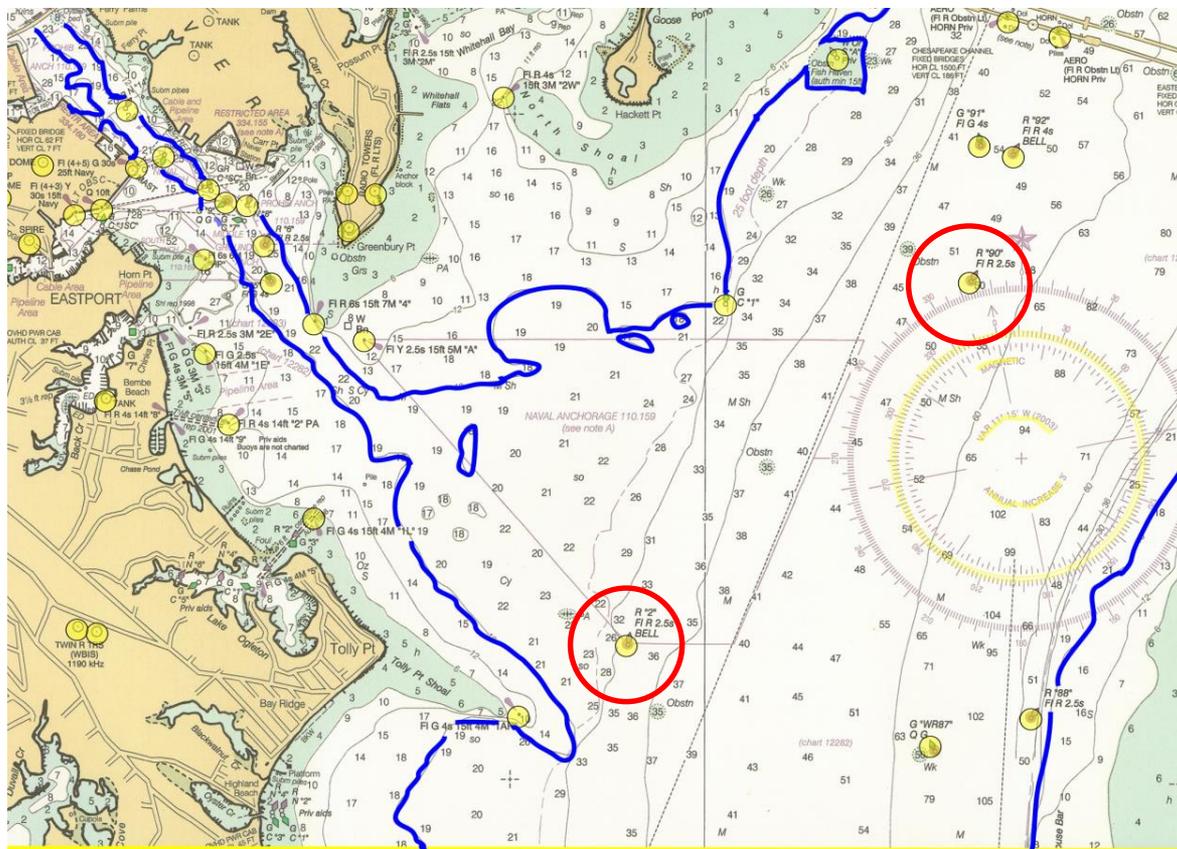


What is the Lat/Long
of R“2” ?

$38^{\circ} 56' 29''$ N
 $076^{\circ} 25' 30''$ W

What is the Lat/Long
of R“90” ?

$38^{\circ} 58' 18''$ N
 $076^{\circ} 23' 20''$ W





GPS Fix



Plot the following GPS coordinates

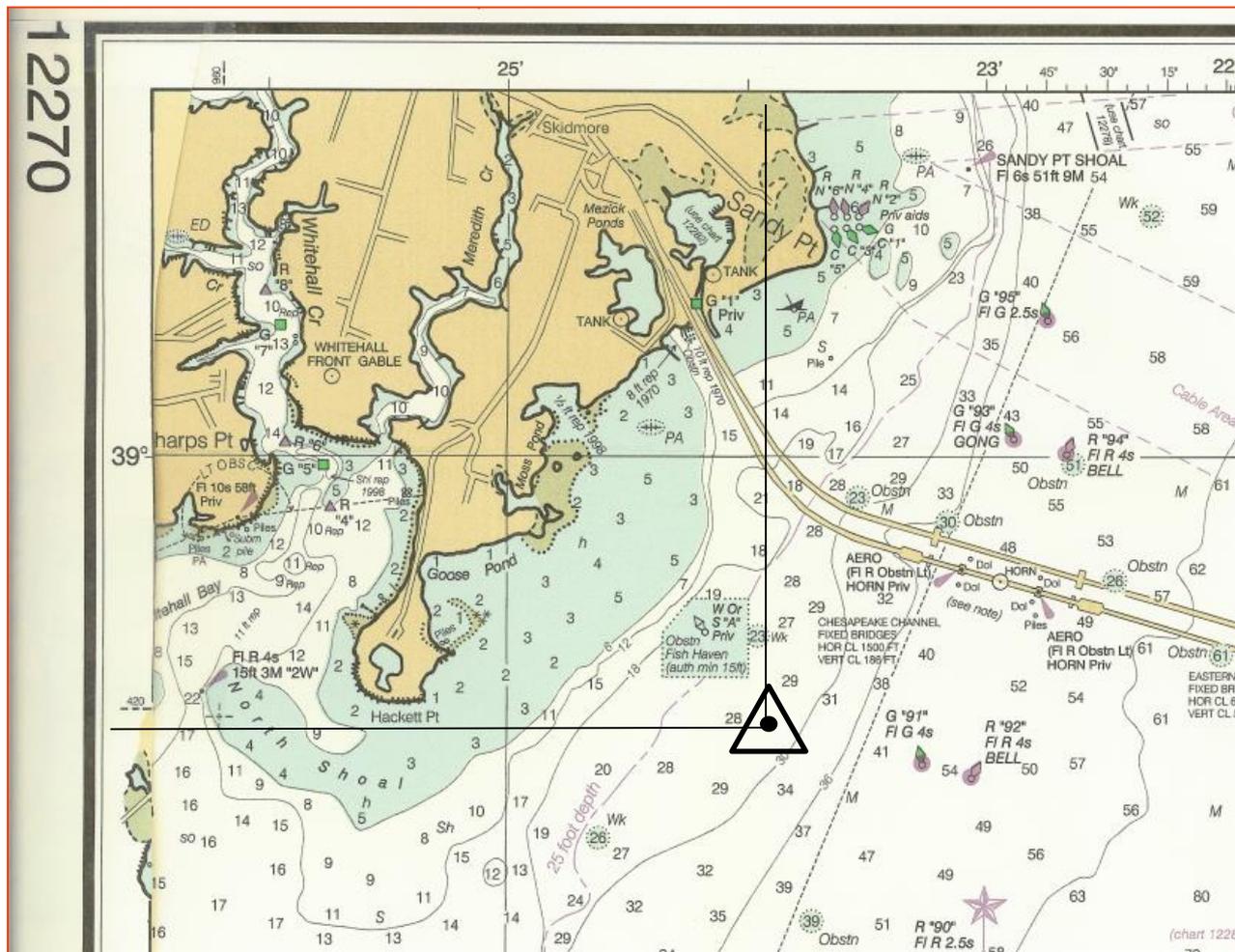
- **Latitude**

$38^{\circ} 58' 30''$ N

- **Longitude**

$76^{\circ} 23' 55''$ W

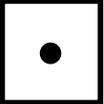
Use proper notation for GPS fix





Symbols



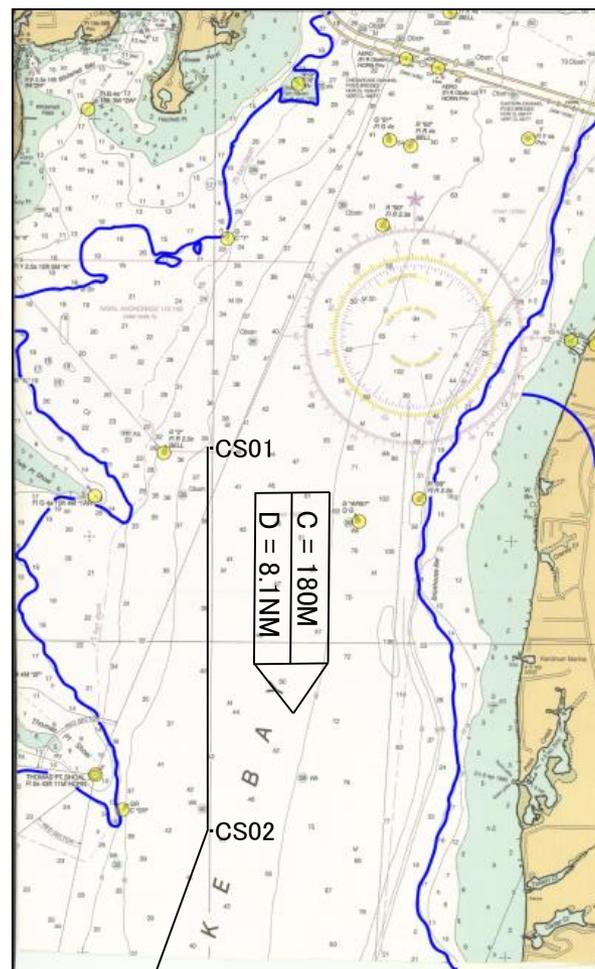
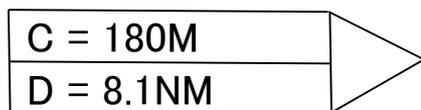
Symbol	Type	Meaning
	Fix	Accurate Visual Fix
	Fix	Accurate Fix obtained by <i>any</i> electronic means
	DR	Dead reckon position
	EP	Estimated position
	ER	<i>Proposed!</i> Estimated reckon



Plot Waypoints and Routes



- Enter lat/long for each waypoint, and label waypoint names CS01, CS02 etc
- Draw route between waypoints in route sequence
- Label route with magnetic heading and Distance





Visual Line of Position



- A single visual L.O.P. provides the navigator a bearing (line) that the vessel is located on
- A visual fix is determined by 3 visual L.O.P.'s to 3 separate navigation visual aids at same time
 - Use optimal spread of visual aids
 - If all the navigational aids are on the same side of the vessel they should be 60° (for 3 aids) apart
 - If all visual L.O.P.'s encircle the vessel they should be 120° apart
 - Priority of L.O.P.'s
 - If one bearing taker is taking all L.O.P.'s the order that they should be taken is beam, bow, stern
- Visual fixes plotted as circle



Visual Fix



- Find 3 objects and shoot a bearing with magnetic compass
- Objects will be identified and labeled on chart during chart prep process, labeled with a “V” for visual, “R” for radar (distinctive land features, RACON buoys)
- Bearing taker and Nav Plotter need to communicate and verify both looking at the same object.
- Draw an LOP on the chart from each of those objects
- Nav Aids: Use land based nav aids as primary, buoys as secondary



6 Rules of Dead Reckoning



- Every hour on the hour
- Every course change
- Every speed change
- Every Fix or Running Fix
- Every new Line of Position (LOP)
- DR twice and label with Course and Speed



Dead Reckoning



- **Formula: Speed (kts) = Distance (nm) / Time (hour)**
- **How to Plot a DR**
 - Speed - 5 kts (Boatspeed)
 - Fix Interval - 12 min
- **Manipulate formula**
- **DR Distance (NM) = Current Speed(KT) x Time(HOUR) DR**
Distance (NM) = 5 kts x .2 hours (12 min) DR Distance
(NM) = 1.0 NM

0830

0842

0854



1.0 NM

1.0 NM



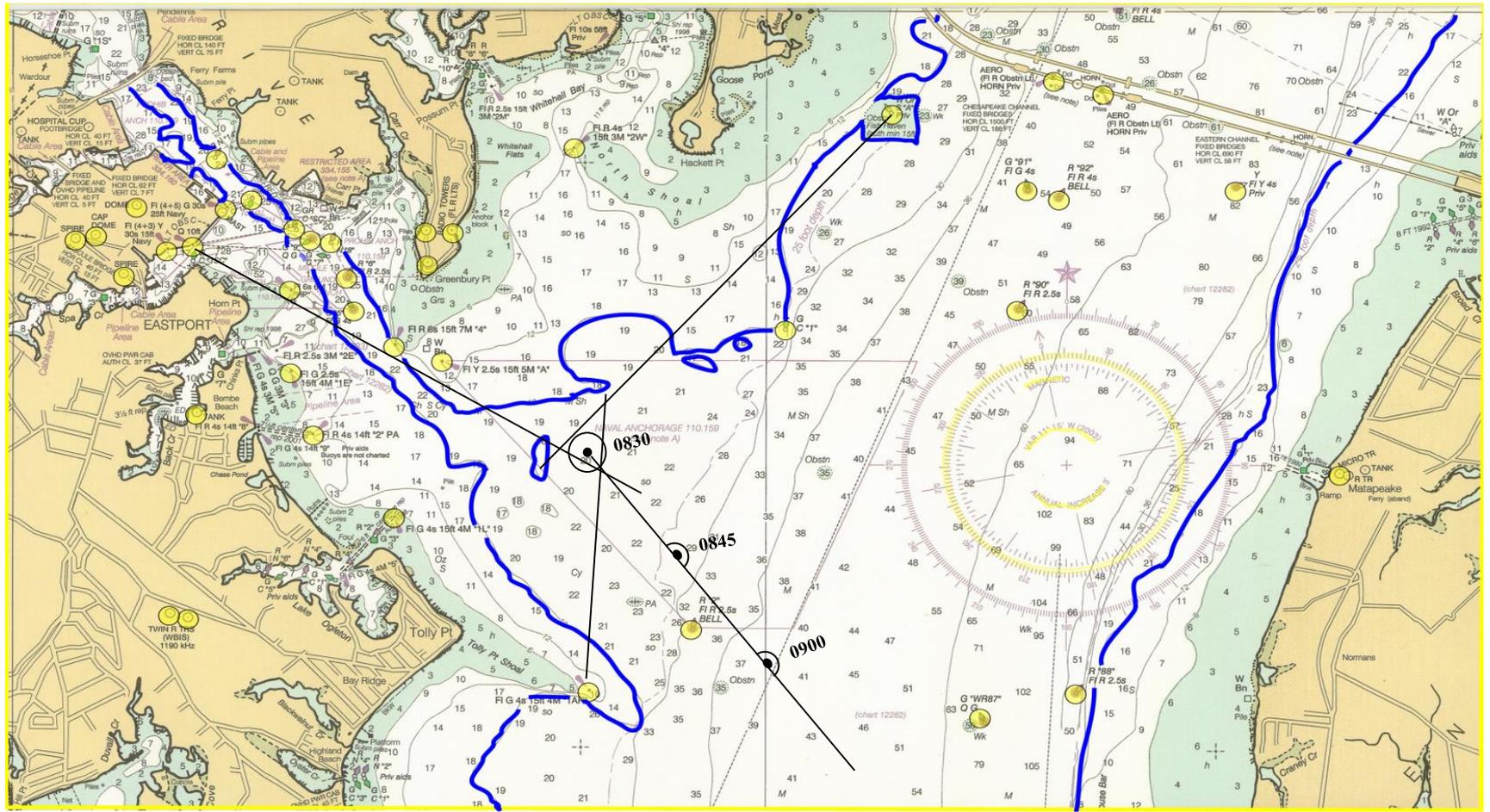
Visual Fix Exercise



- Find 3 objects and shoot a bearing with magnetic compass
- Draw an LOP from each of those objects
- **Plot your fix and DR on course heading, not course over ground**
 - **DR Distance = Current Speed X Time (fix interval)**



Visual Fix



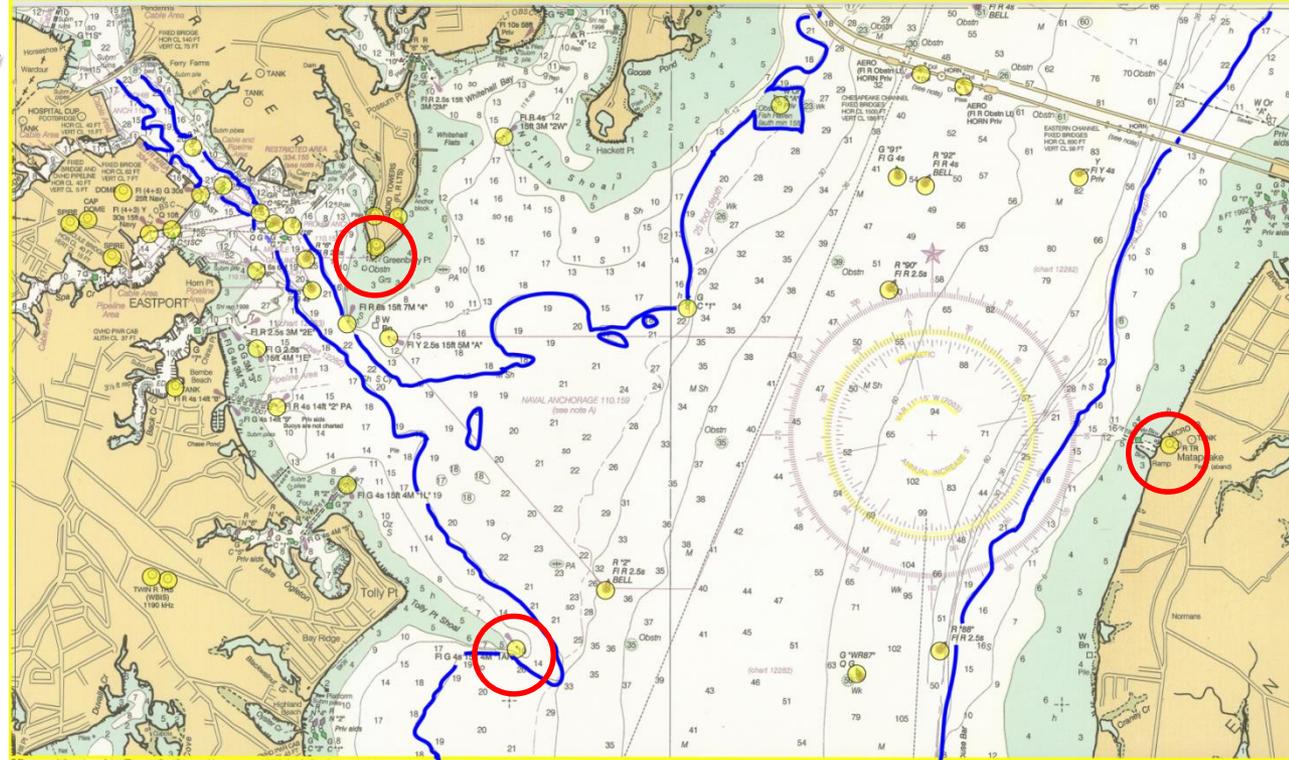
Visual Fix with DR



Visual Fix Exercise



Eastern Shore
Matapeake Tower V-MT
092M
Greenbury PT Tower V-
GP1
318M
Tolly Point Light V-1AH
244M
Course
190M
Speed
5 kts
Fix Interval
6 min

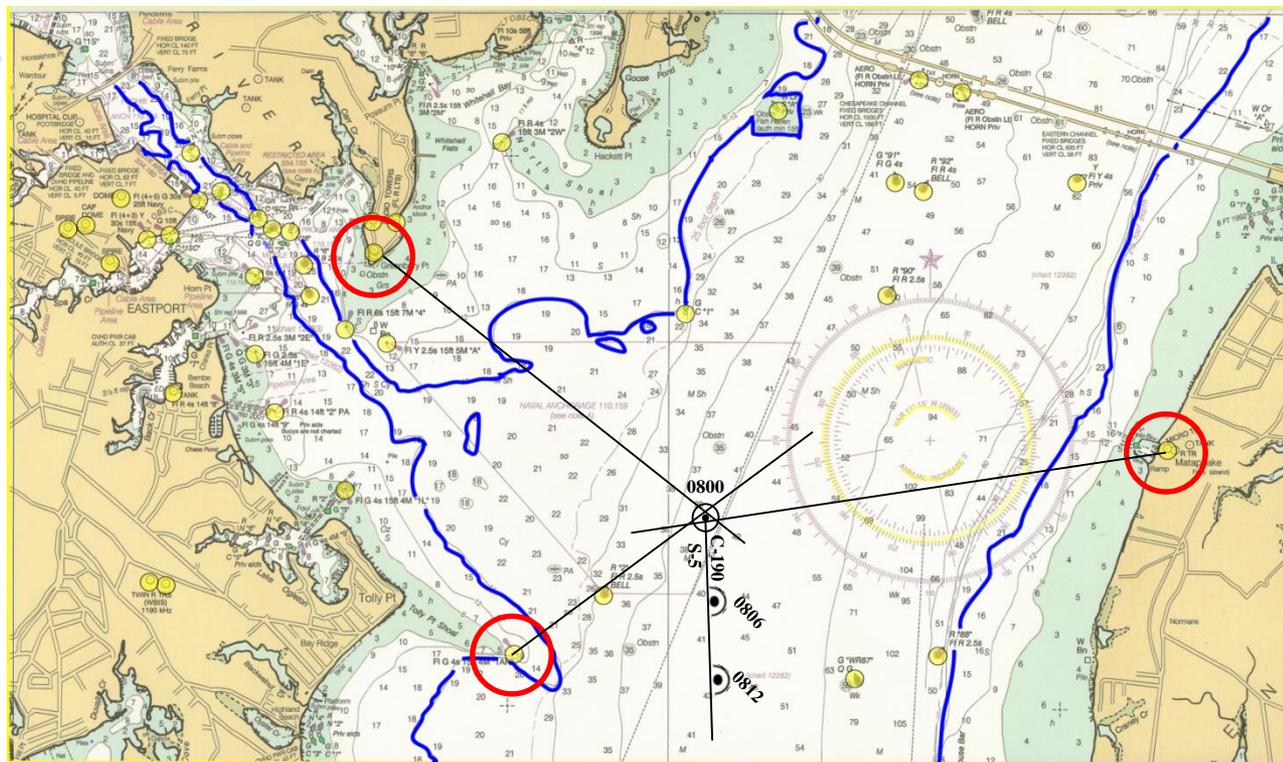




Visual Fix Exercise



Eastern Shore
Matapeake Tower V-MT
092M
Greenbury PT Tower V-
GP1
318M
Tolly Point Light V-1AH
244M
Course
190M
Speed
5 kts
Fix Interval
6 min





Bearing Log



- **Place: General location**
- **“Magnetic Only”**
- **Date (when changed) and time of bearings**
- **Name of bearing target (each possible target highlighted with yellow circle and labeled per Chart Preparation Checklist)**
- **Bearing to target**
- **Depth from vessel depth sounder at time of bearings (to be checked against depth of plotted position)**

Gyro Bearings

Date	Time				Depth
13-Apr-14	1000	V-TP	V-GP1	V-BBT	
	1015			V-R2	
	1030			V-BP	

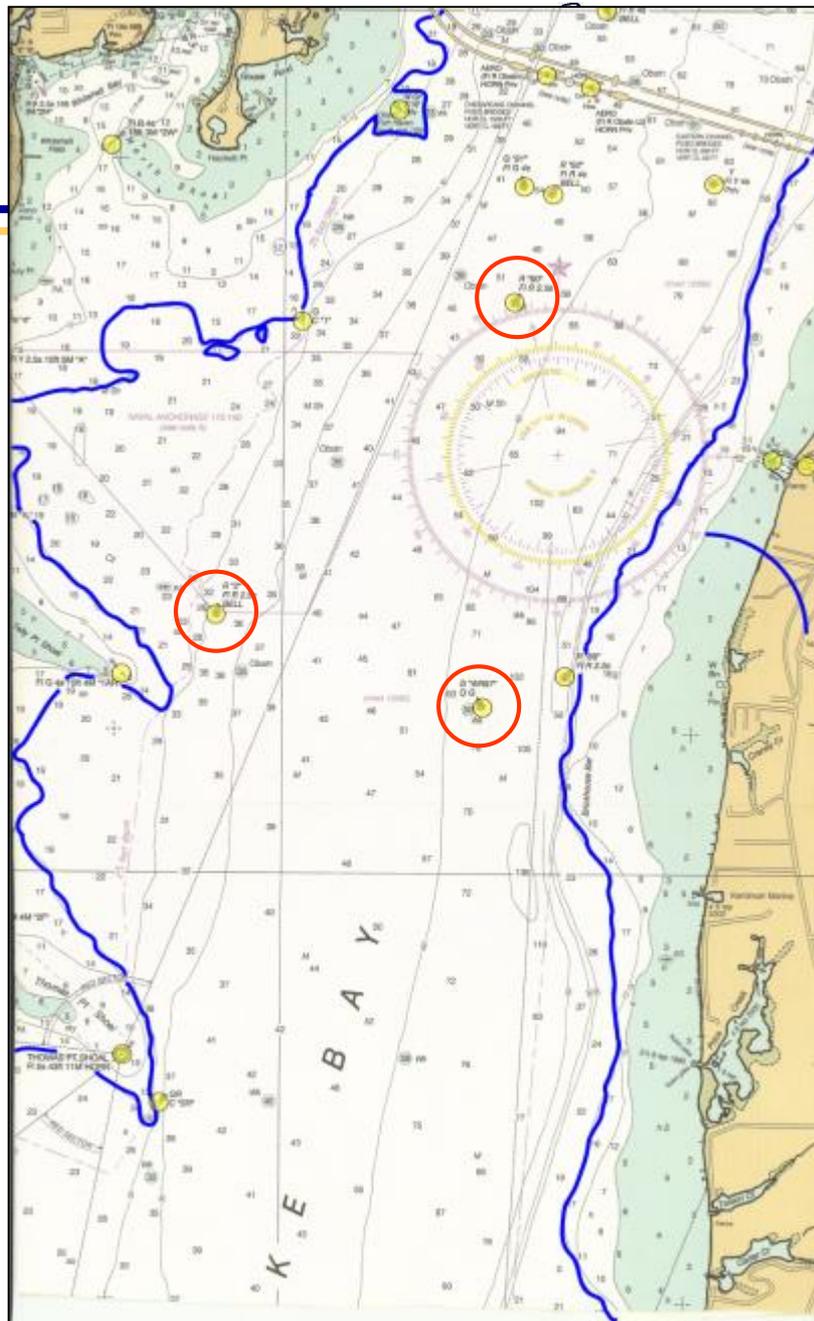
Note: In the original image, several cells in the table are circled in red: '13-Apr-14', '1000', 'V-TP', 'V-GP1', 'V-BBT', 'V-R2', '1015', '2', '285', '265', 'V-BP', '1030', '15', '250', '35', and '56'. Additionally, 'Place Annapolis 12270' and 'Magnetic Only' are circled in red above the table.



Visual Fix Soundings Bearing Log

- At 1230, you identify:
 - R “2”: 258M (V-R2)
 - R “90”: 042M (V-R90)
 - G “WR87”: 162M (V-G87)
 - Depth: 46'

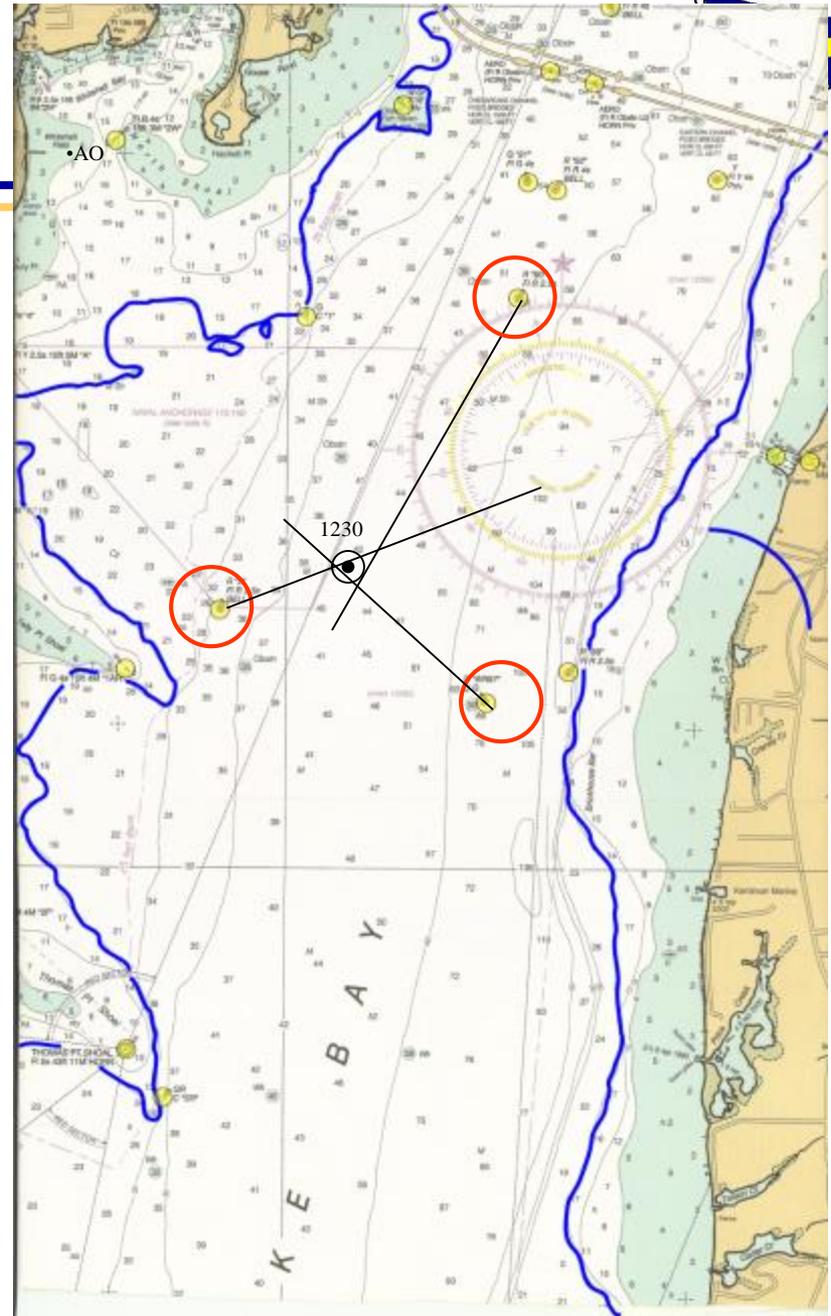
Record these bearings in your bearing log with proper notation.





Create a Fix from *LOPs* and Soundings

- At 1230, you determine:
 - R “2”: 258M
 - R “90”: 042M
 - G “WR87”: 162M
 - Depth: 46’
- Plot the fix.





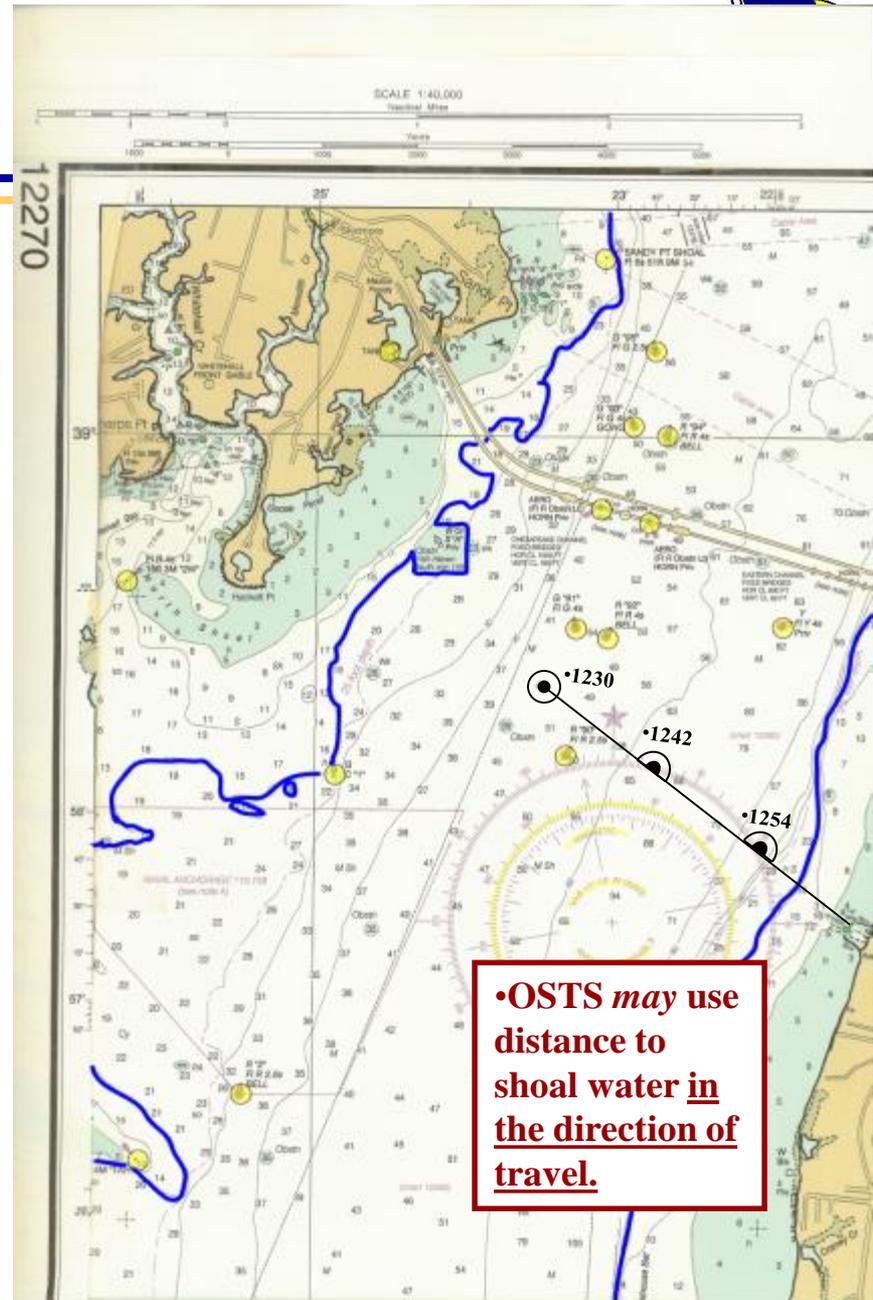
Determine the latest time for the next fix

- Plot the DR from the fix with your given course, C, and speed, S (knots).
- From the fix, determine the closest distance, D (nm), to shoal water. **2 nm.**
- Divide by two for the half interval. **1 nm**
- With the formula $T = D/S$, calculate T (hours). Convert to minutes and divide by two for the time interval to the next fix. **12 min**
- If the calculated time interval is less than the CO's fix interval, **Recommend that CO shorten fix interval!**
- Add the time interval to the fix time. This is the latest time for the next fix. **1242**

CO's initial fix interval is 15 min.

$$\begin{aligned} T &= 1.0/5.0 \\ &= .2 \text{ hr} \\ &= 12 \text{ min} \end{aligned}$$

$$\begin{aligned} 1230 + 12 \\ &= 1242 \end{aligned}$$



•OSTS may use distance to shoal water in the direction of travel.



Mathematical Conversions



- Get out some scrap paper
- We are going to cover some common conversions you will encounter while navigating





Converting Lat/Long



- Converting Latitude/Longitude from Decimal to Degrees, Minutes, Seconds and vice versa
- Many GPS units will display as $38^{\circ} 57.5' N$
- Your waypoint may be in seconds as degrees and you need to plot on a chart with seconds as decimal

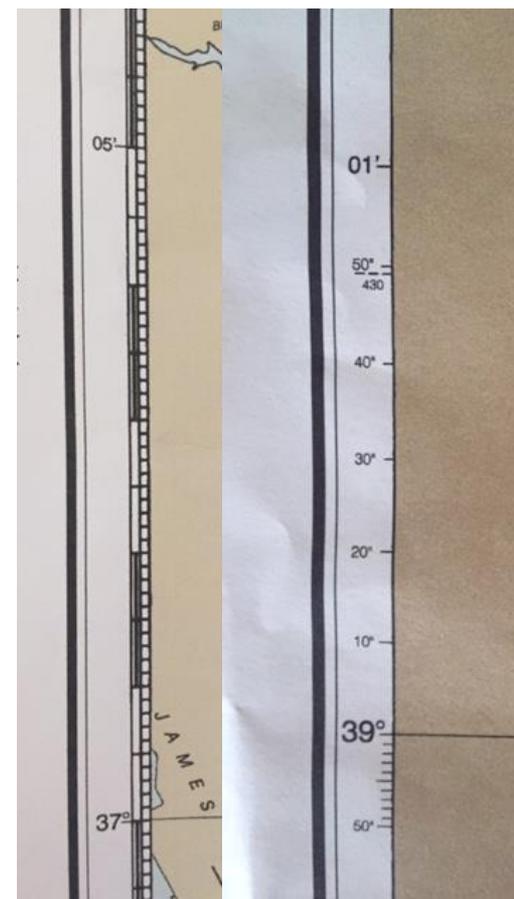
Seconds as Decimal $\times 60 =$ Seconds as Degrees

Seconds as Degrees $/ 60 =$ Seconds as Decimal

$$38^{\circ} 57.5' N = 38^{\circ} 57' 30'' N$$

Seconds/decimal

Seconds/degrees





Converting Lat/Long



- Convert the following:

$076^{\circ} 05' 45'' \text{ W} = \text{XX}^{\circ} \text{XX}.X'$

$076^{\circ} 05.75' \text{ W}$

$37^{\circ} 05' 15'' \text{ N} = \text{XX}^{\circ} \text{XX}.X'$

$37^{\circ} 05.25' \text{ N}$

$072^{\circ} 43.50' \text{ W} = \text{XX}^{\circ} \text{XX}' \text{XX}''$

$072^{\circ} 43' 30'' \text{ W}$

$34^{\circ} 09.20' \text{ N} = \text{XX}^{\circ} \text{XX}' \text{XX}''$

$34^{\circ} 09' 12'' \text{ N}$

Datum 000 WGS 1984	Log 1 113904.nm	Log 2 110797.nm
LAT	12°00.018 N	
LON	69°00.001 W	
Speed 15.3kn	Course 288°	Altitude 2D 30 m
Status DGPS 7Sat A	Local time 12:26:42	Local date 13-10-2006

SHIPMATE DC30



Time/Speed/Distance



- **Calculations to Memorize**
 - **Distance (NM) = Speed (knots) x Time (Hours)**
 - **1 NM = ~2000 Yards**
- **Problems:**
 - **3.6 NM = XX Yards**
 - **8.2 NM = XX Yards**
 - **6,500 Yards = XX NM**
 - **15,200 Yards = XX NM**
 - **At 6 knots, how far will you travel in 20 min?**
 - **You are 8,000 yards from shoal. At 8 knots, how much time do you have before shoal?**



Time/Speed/Distance



- Calculations to Memorize
 - Distance (NM) = Speed (knots) x Time (Hours)
 - 1 NM = ~2000 Yards
- Problems:
 - 3.6 NM = **7,200 Yards**
 - 8.2 NM = **16,400 Yards**
 - 6,500 Yards = **3.25 NM**
 - 15,200 Yards = **7.6 NM**
 - At 6 knots, how far will you travel in 20 min? **2 NM**
 - You are 8,000 yards from shoal. At 8 knots, how much time do you have before shoal? **30 minutes**



Time/Speed/Distance



- How far do you travel in 20 minutes at 7.5 knots?

2.5 nm

- You pass G "91" abeam at 1315 at 5.6 knots. How far from G"91" are you at 1400?

4.2 nm



Questions?

